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THE MARCH MEETING OF THE OHIO SECTION.

The sixth regular meeting of the Ohio Section was held at the Chemistry Building, Ohio State University, Columbus, on March 25, 1921, in connection with the meetings of the Ohio College Association. An afternoon and an evening session were held. Professor S. E. RASOR occupied the chair, being relieved by Professor HARRIS HANCOCK for an interval.

Forty-five persons were registered, the following twenty-seven being members of the Association:

R. B. Allen, W. E. Anderson, G. N. Armstrong, C. L. Arnold, C. B. Austin, Grace M. Bareis, W. S. Beckwith, A. A. Bennett, R. D. Bohannon, W. D. Cairns, A. G. Caris, V. B. Caris, E. H. Clarke, O. L. Dustheimer, T. M. Focke, Harris Hancock, H. W. Kuhn, C. N. Moore, C. C. Morris, Amy F. Preston, S. E. Rasor, Hortense Rickard, K. D. Swartzel, T. E. Trott, J. H. Weaver, R. B. Wildermuth, F. B. Wiley.

At the business session, the secretary reported a membership of 68 and 8 institutional members, as against 70 and 8, respectively, last year. The officers elected for this year are: Chairman, Professor B. F. YANNEY, College of Wooster; Secretary-Treasurer, Professor G. N. ARMSTRONG, Ohio Wesleyan University; third member of executive committee, Professor K. D. SWARTZEL, Ohio State University.

There were 32 persons present at the evening dinner and session held at the Ohio Union. The after-dinner reports upon the mathematical situation in twelve institutions were full of information and inspiration.

The following ten papers were presented at the regular meeting:

- (1) Chairman's Address: "Functions and functionals" by Professor S. E. RASOR, Ohio State University;
- (2) "An inquiry regarding collegiate departments of applied mathematics" by Professor G. N. ARMSTRONG, Ohio Wesleyan University;
- (3) "Ballistic tables" by Professor A. A. BENNETT, University of Texas;
- (4) "Mathematics in accounting" by Mr. W. E. LANGDON, Secretary of the Ohio Society of Certified Public Accountants, Columbus;
- (5) "The problem of three bodies" by Professor E. S. MANSON, professor of astronomy, Ohio State University;
- (6) "Mathematics and patent law" by Mr. S. S. DUNHAM, of Kerr, Page, Cooper & Hayward, New York City;
- (7) "Mathematical problems in the work of the U. S. Coast and Geodetic Survey" by W. D. LAMBERT and O. S. ADAMS, Geodetic Division, U. S. Coast and Geodetic Survey;
- (8) "Statistics, a comparison of the correlation coefficient and best-line deviation methods" by Professor W. D. CAIRNS, Oberlin College;
- (9) "Solutions of the equation $\xi^2 + \eta^2 = \zeta^2$, where ξ , η , ζ are quadratic integers" by Professor HARRIS HANCOCK, University of Cincinnati;

(10) "Discussion of the reports of the National Committee on Mathematical Requirements" by Dr. C. N. MOORE, University of Cincinnati, Mr. J. C. BOLDT, Stivers High School, Dayton, and Miss MARIE GUGLE, Assistant Superintendent of Schools, Columbus.

Abstracts of the papers follow below, the numbers corresponding to the numbers in the list of titles:

1. In Professor Rasor's paper the general idea of function was developed by reference to the work of Descartes, Leibniz, Euler, d'Alembert, and Dirichlet. This idea of function was then extended to functions of a line. Continuity, successive derivatives, and successive variations were then defined for them with the proof, by limits and by analogy, of the symmetry of the parameters entering in the second and higher derivatives. Illustrations of these functions of lines were given from the calculus of variations and in a generalization of Taylor's theorem. Euler's equation from the calculus of variations, thought of as a function of a line, was shown to be precisely the Volterra derivative.

2. Professor Armstrong's inquiry regarding collegiate departments of applied mathematics concerned itself with the content, conduct and administration of such courses and departments, and was based not only upon his own opinions but also upon the answers to a questionnaire on the topic, which was submitted to about 85 professors of mathematics in Ohio and other states. The main conclusions were these: There are no generally accepted definitions of pure and applied mathematics, although two types have been long recognized. Very few American universities make even a nominal distinction in their organization; that attempts to separate the two should be avoided, is the opinion of a large majority of mathematicians; what a great many of our institutions have been labeling "applied mathematics" is really "preengineering mathematics"; there is very little research work in applied mathematics being done here of the kind carried on in certain European universities,—Edinburgh and Göttingen among others; the interest in the applications of mathematics has existed long and is increasing; men with tastes and talents in either line are equally worthy of encouragement and support in our faculties. An attempt was made to put into four groups all courses popularly considered as applied mathematics, and a list of thirty-five such courses was given. The latest to come into college instruction are those based upon the "error curve" and the "compound interest law." Formal instruction in computation is highly desirable.

3. Dr. Bennett discussed in this paper some physical and mathematical features connected with the question of the motion of projectiles. The primary problem for artillery is the range to be obtained. This is fundamentally empirical and is determined by firings. The range under standard conditions being once secured, the computation of changes in range for slight variations in conditions of firing is best derived from physical theory by mathematical methods. The nature and construction of tables was discussed.

4. In his paper Mr. Langdon stated that modern business concerns depend on accounting, in order to keep track of cash, customers' accounts or accounts

receivable, creditors' accounts or accounts payable, notes, material or merchandise, payrolls, equipment, investments, etc., as well as to determine the profit or loss. He listed the different kinds of accounting as: Single entry bookkeeping or memorandum records; double entry bookkeeping; auditing; statistical reports; graphic charts; business systems; cost accounting; income tax reports. He discussed the problems arising in each, dwelling particularly upon: (a) The purposes of an audit, which are, to ascertain the actual financial condition and earnings of an enterprise; to make income tax reports; to detect irregularities or errors; and (b): Cost accounting, which aids in the establishment of correct selling prices; coöperation between sales department and factory; elimination of waste and the preparation of periodical balance sheets, profit and loss, and income statements.

5. Professor Manson's paper consisted of a brief discussion of some points connected with the problem of three bodies, particularly the restricted case where the motion of a body of infinitesimal mass subject to the attraction of two finite masses which are themselves revolving in circles about their common center of mass is considered. It was shown analytically and also by a geometrical construction that if the infinitesimal body is in the plane of the orbits of the two finite masses and forms an equilateral triangle with them it will under proper initial conditions remain in equilibrium in this relative position and so maintain the equilateral configuration. The question of the stability of this solution was briefly discussed. Mention was made of the fact that the six asteroids of the so-called Trojan group seem to be oscillating with respect to these equilateral triangle points of equilibrium; two being about 60° behind Jupiter and the other four about 60° in advance. The fact of the existence of three straight line points of equilibrium; one between the two finite bodies, one between the first finite body and minus infinity and one between the second finite body and plus infinity, was also mentioned.

6. Mr. Dunham's paper contained a brief discussion of the nature of patents for inventions, and the reasons why a knowledge of mathematics beyond the rudiments of the science is a useful part of the patent lawyer's equipment, as a means of checking theories and effects, confirming results, detecting fallacies, etc., and as a means of generalizing. Illustrations having mathematical bearing were drawn from the speaker's experience.

7. The paper by Mr. Lambert and Mr. Adams will be published in the next issue of this MONTHLY.

8. Professor Cairns summarized the Bravais-Galton-Pearson method of finding the correlation coefficient and the regression equations from which, for given values of one or more variables, are found corresponding values of a dependent variable with the least (mean square) deviation of that variable. He contrasted with this the case occurring frequently, where there is no reason to regard one variable as depending on the others in the sense of cause and effect. A closer fit for a line in two variables or a plane in three variables can be obtained by imposing the condition that the mean square of the *normal* distances shall be

a minimum; like results hold for more than three variables. This is a direct generalization of the standard deviation method of comparing different distributions and yields a unique equation of relation between a variable as opposed to the usually inconsistent regression equations of the Pearson method. A short process for obtaining a first approximation for the best line or plane was given.

9. In this paper Prof. Hancock showed if $c_2 = (k^2 + l^2)[1 - m^2 - p^2]$, $c_1 = mk + pl$, $b_1 = k + p(ml - pk)$, $a_1 = l + m(pk - ml)$, $b_2 = [(ml - pk)^2 - k^2][1 - m^2 - p^2]$, $a_2 = [(pk - ml)^2 - l^2][1 - m^2 - p^2]$, (k, l, m, p , arbitrary rational integers), be written in the equations: $x^2 - 2a_1x - a_2 = 0$ (a_1, a_2 rational integers), $y^2 - 2b_1y - b_2 = 0$ (b_1, b_2 rational integers), $z^2 - 2c_1z - c_2 = 0$ (c_1, c_2 rational integers), the roots of these three equations, *i.e.*, the algebraic quadratic integers ξ, η, ζ , say, satisfy the equation $\xi^2 + \eta^2 = \zeta^2$.

10. Prof. Moore presented a statement concerning the aims and progress of the reports of the National Committee on Mathematics Requirements. The succeeding discussion, by Mr. Boldt and Miss Gule, dealt chiefly with the report on junior high school mathematics. In the succeeding general discussion, Prof. Weaver, speaking from experience in vocational and other schools, appealed for attention to the preparation of teachers as well as of students. Prof. Wildermuth emphasized the necessity of holding students to strict account for the work assigned; Professor Kuhn related his experiences with beginning junior high school mathematics in his own family. Further participants in the spirited discussions were Professors Beatty, Bennett, Rasor, and Dustheimer, and Supt. Collicott, and Miss Amy F. Preston of the Columbus Schools.

G. N. ARMSTRONG, *Secretary-Treasurer*.

NEW INFORMATION RESPECTING ROBERT RECORDE.

By DAVID EUGENE SMITH, Columbia University.

Our knowledge of Robert Recorde, the first mathematician of any note to publish works in the English language, is very meager. In general, recent writers have trusted to the books which he wrote and to various biographical notes that have appeared,—the former affording evidence of undoubted value, but the latter being little more than tradition.

Recorde's tombstone in the parish church at Tenby, Pembrokeshire, might be expected to be of assistance, but it turns out to be a modern one, affording no information of value. The inscription is as follows (compare the frontispiece):

IN MEMORY OF
ROBERT RECORDE,
THE EMINENT MATHEMATICIAN,
WHO WAS BORN AT TENBY, CIRCA 1510.
TO HIS GENIUS WE OWE THE EARLIEST
IMPORTANT ENGLISH TREATISES ON
ALGEBRA, ARITHMETIC, ASTRONOMY, AND GEOMETRY;
HE ALSO INVENTED THE SIGN OF